

Pro Arg Ala Ile Arg Thr Arg Tyr Leu Arg Thr Trp Phe Leu Val Asp  
165 170 175

Leu	Ile	Ser	Ser	Ile	Pro	Val	Asp	Tyr	Ile	Phe	Leu	Val	Val	Glu	Leu
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Glu	Pro	Arg	Leu	Asp	Ala	Glu	Val	Tyr	Lys	Thr	Ala	Arg	Ala	Leu	Arg
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Ile	Val	Arg	Phe	Thr	Lys	Ile	Leu	Ser	Leu	Leu	Arg	Leu	Leu	Arg	Leu
	210					215					220				
Ser	Arg	Leu	Ile	Arg	Tyr	Ile	His	Gln	Trp	Glu	Glu	Ile	Phe	His	Met
225					230					235					240
Thr	Tyr	Asp	Leu	Ala	Ser	Ala	Val	Val	Arg	Ile	Phe	Asn	Leu	Ile	Gly
				245					250					255	
Met	Met	Leu	Leu	Leu	Cys	His	Trp	Asp	Gly	Cys	Leu	Gln	Phe	Leu	Val
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Pro	Met	Leu	Gln	Asp	Phe	Pro	Pro	Asp	Cys	Trp	Val	Ser	Ile	Asn	His
		275					280					285			
Met	Val	Asn	His	Ser	Trp	Gly	Arg	Gln	Tyr	Ser	His	Ala	Leu	Phe	Lys
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Ala	Met	Ser	His	Met	Leu	Cys	Ile	Gly	Tyr	Gly	Gln	Gln	Ala	Pro	Val
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Gly	Met	Pro	Asp	Val	Trp	Leu	Thr	Met	Leu	Ser	Met	Ile	Val	Gly	Ala
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Thr	Cys	Tyr	Ala	Met	Phe	Ile	Gly	His	Ala	Thr	Ala	Leu	Ile	Gln	Ser
			340					345					350		
Leu	Asp	Ser	Ser	Arg	Arg	Gln	Tyr	Gln	Glu	Lys	Tyr	Lys	Gln	Val	Glu
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Gln	Tyr	Met	Ser	Phe	His	Lys	Leu	Pro	Ala	Asp	Thr	Arg	Gln	Arg	Ile
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Ser	Ile	Leu	Gly	Glu	Leu	Ser	Glu	Pro	Leu	Arg	Glu	Glu	Ile	Ile	Asn
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Phe	Thr	Cys	Arg	Gly	Leu	Val	Ala	His	Met	Pro	Leu	Phe	Ala	His	Ala
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Asp	Pro	Ser	Phe	Val	Thr	Ala	Val	Leu	Thr	Lys	Leu	Arg	Phe	Glu	Val
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Phe	Gln	Pro	Gly	Asp	Leu	Val	Val	Arg	Glu	Gly	Ser	Val	Gly	Arg	Lys
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Met	Tyr	Phe	Ile	Gln	His	Gly	Leu	Leu	Ser	Val	Leu	Ala	Arg	Gly	Ala
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Arg	Asp	Thr	Arg	Leu	Thr	Asp	Gly	Ser	Tyr	Phe	Gly	Glu	Ile	Cys	Leu
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Leu Thr Arg Gly Arg Arg Thr Ala Ser Val Arg Ala Asp Thr Tyr Cys  
 500 505 510  
 Arg Leu Tyr Ser Leu Ser Val Asp His Phe Asn Ala Val Leu Glu Glu  
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 Phe Pro Met Met Arg Arg Ala Phe Glu Thr Val Ala Met Asp Arg Leu  
 530 535 540  
 Leu Arg Ile Gly Lys Lys Asn Ser Ile Leu Gln Arg Lys Arg Ser Glu  
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 Pro Ser Pro Gly Ser Ser Gly Gly Ile Met Glu Gln His Leu Val Gln  
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 His Asp Arg Asp Met Ala Arg Gly Val Arg Gly Arg Ala Pro Ser Thr  
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 Gly Ala Gln Leu Ser Gly Lys Pro Val Leu Trp Glu Pro Leu Val His  
 595 600 605  
 Ala Pro Leu Gln Ala Ala Ala Val Thr Ser Asn Val Ala Ile Ala Leu  
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 Thr His Gln Arg Gly Pro Leu Pro Leu Ser Pro Asp Ser Pro Ala Thr  
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 660 665 670  
 Ala Pro Pro Ala Arg Thr Leu His Ala Ser Leu Ser Arg Ala Gly Arg  
 675 680 685  
 Ser Gln Val Ser Leu Leu Gly Pro Pro Pro Gly Gly Gly Gly Arg Arg  
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 705 710 715 720  
 Gln Arg Ala Thr Gly Asp Gly Ser Pro Gly Arg Lys Gly Ser Gly Ser  
 725 730 735  
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 Gln Leu Ser Ala Asn Met  
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<210> 2  
 <211> 2325  
 <212> DNA  
 <213> Homo sapiens

&lt;220&gt;

<223> human hyperpolarization-activated voltage-gated  
cation channel 3 (HAC3)

&lt;400&gt; 2

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&lt;210&gt; 3

&lt;211&gt; 24

&lt;212&gt; DNA

&lt;213&gt; Artificial Sequence

&lt;220&gt;

<223> Description of Artificial Sequence: amplification  
primer

&lt;400&gt; 3

cagccatgga ggcagagcag cggc



\*220>  
 <223> Description of Artificial Sequence:degenerate  
 amplification primer  
  
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 <222> (16)  
 <223> n = g, a, c or t  
  
 <220>  
 <221> modified\_base  
 <222> (25)  
 <223> n = g, a, c or t  
  
 <400> 8  
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 <210> 9  
 <211> 26  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
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 RACE gene specific primer  
  
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 <211> 25  
 <212> DNA  
 <213> Artificial Sequence  
  
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 nested 5' RACE gene specific primer  
  
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 <211> 27  
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 <220>  
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 <211> 25  
 <212> DNA  
 <213> Artificial Sequence

25

25

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Lys Gly Ser Pro Asn Gly Glu Cys Gly Arg Gly Glu Pro Gln Cys Ser  
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			100						105						110		
Cys	Arg	Gly	Ala	Ala	Ser	Gly	Pro	Ala	Pro	Gly	Pro	Gly	Pro	Ala	Glu		
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Glu	Ala	Gly	Ser	Glu	Glu	Ala	Gly	Pro	Ala	Gly	Glu	Pro	Arg	Gly	Ser		
		130				135					140						
Gln	Ala	Ser	Phe	Met	Gln	Arg	Gln	Phe	Gly	Ala	Leu	Leu	Gln	Pro	Gly		
145					150					155					160		
Val	Asn	Lys	Phe	Ser	Leu	Arg	Met	Phe	Gly	Ser	Gln	Lys	Ala	Val	Glu		
				165					170					175			
Arg	Glu	Gln	Glu	Arg	Val	Lys	Ser	Ala	Gly	Ala	Trp	Ile	Ile	His	Pro		
			180					185					190				
Tyr	Ser	Asp	Phe	Arg	Phe	Tyr	Trp	Asp	Phe	Thr	Met	Leu	Leu	Phe	Met		
		195					200					205					
Val	Gly	Asn	Leu	Ile	Ile	Ile	Pro	Val	Gly	Ile	Thr	Phe	Phe	Lys	Asp		
	210					215					220						
Glu	Thr	Thr	Ala	Pro	Trp	Ile	Val	Phe	Asn	Val	Val	Ser	Asp	Thr	Phe		
225					230					235					240		
Phe	Leu	Met	Asp	Leu	Val	Leu	Asn	Phe	Arg	Thr	Gly	Ile	Val	Ile	Glu		
				245					250					255			
Asp	Asn	Thr	Glu	Ile	Ile	Leu	Asp	Pro	Glu	Lys	Ile	Lys	Lys	Lys	Tyr		
			260					265					270				
Leu	Arg	Thr	Trp	Phe	Val	Val	Asp	Phe	Val	Ser	Ser	Ile	Pro	Val	Asp		
		275					280					285					
Tyr	Ile	Phe	Leu	Ile	Val	Glu	Lys	Gly	Ile	Asp	Ser	Glu	Val	Tyr	Lys		
	290					295					300						
Thr	Ala	Arg	Ala	Leu	Arg	Ile	Val	Arg	Phe	Thr	Lys	Ile	Leu	Ser	Leu		
305					310					315					320		
Leu	Arg	Leu	Leu	Arg	Leu	Ser	Arg	Leu	Ile	Arg	Tyr	Ile	His	Gln	Trp		
				325					330					335			
Glu	Glu	Ile	Phe	His	Met	Thr	Tyr	Asp	Leu	Ala	Ser	Ala	Val	Met	Arg		
			340					345					350				
Ile	Cys	Asn	Leu	Ile	Ser	Met	Met	Leu	Leu	Leu	Cys	His	Trp	Asp	Phe		
		355					360					365					
Cys	Leu	Gln	Phe	Leu	Val	Pro	Met	Leu	Gln	Asp	Phe	Pro	Arg	Asn	Cys		
		370				375					380						
Trp	Val	Ser	Ile	Asn	Gly	Met	Val	Asn	His	Ser	Trp	Ser	Glu	Leu	Tyr		
385					390					395					400		
Ser	Phe	Ala	Leu	Phe	Lys	Ala	Met	Ser	His	Met	Leu	Cys	Ile	Gly	Tyr		



Gly	Arg	Gln	Ala	Pro	Glu	Ser	Met	Thr	Asp	Ile	Trp	Leu	Thr	Met	Leu
			420						425						430
Ser	Met	Ile	Val	Gly	Ala	Thr	Cys	Tyr	Ala	Met	Phe	Ile	Gly	His	Ala
		435					440					445			
Thr	Ala	Leu	Ile	Gln	Ser	Leu	Asp	Ser	Ser	Arg	Arg	Gln	Tyr	Gln	Glu
	450					455					460				
Lys	Tyr	Lys	Gln	Val	Glu	Gln	Tyr	Met	Ser	Phe	His	Lys	Leu	Pro	Ala
465					470					475					480
Asp	Phe	Arg	Gln	Lys	Ile	His	Asp	Tyr	Tyr	Glu	His	Arg	Tyr	Gln	Gly
				485					490					495	
Lys	Met	Phe	Asp	Glu	Asp	Ser	Ile	Leu	Gly	Glu	Leu	Asn	Gly	Pro	Leu
			500					505					510		
Arg	Glu	Glu	Ile	Val	Asn	Phe	Asn	Cys	Arg	Lys	Leu	Val	Ala	Ser	Met
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Pro	Leu	Phe	Ala	Asn	Ala	Asp	Pro	Asn	Phe	Val	Thr	Ala	Met	Leu	Thr
	530					535					540				
Lys	Leu	Lys	Phe	Glu	Val	Phe	Gln	Pro	Gly	Asp	Tyr	Ile	Ile	Arg	Glu
545					550					555					560
Gly	Thr	Ile	Gly	Lys	Lys	Met	Tyr	Phe	Ile	Glx	His	Gly	Val	Val	Ser
				565					570					575	
Val	Leu	Thr	Lys	Gly	Asn	Lys	Glu	Met	Lys	Leu	Ser	Asp	Gly	Ser	Tyr
			580					585					590		
Phe	Gly	Glu	Ile	Cys	Leu	Leu	Thr	Arg	Gly	Arg	Arg	Thr	Ala	Ser	Val
		595					600					605			
Arg	Ala	Asp	Thr	Tyr	Cys	Arg	Leu	Tyr	Ser	Leu	Ser	Val	Asp	Asn	Phe
	610					615					620				
Asn	Glu	Val	Leu	Glu	Glu	Tyr	Pro	Met	Met	Arg	Arg	Ala	Phe	Glu	Thr
625					630					635					640
Val	Ala	Ile	Asp	Arg	Leu	Asp	Arg	Ile	Gly	Lys	Lys	Asn	Ser	Ile	Leu
				645					650					655	
Leu	His	Lys	Val	Gln	His	Asp	Leu	Asn	Ser	Gly	Val	Phe	Asn	Asn	Gln
			660					665					670		
Glu	Asn	Ala	Ile	Ile	Gln	Glu	Ile	Val	Lys	Tyr	Asp	Arg	Glu	Met	Val
		675					680					685			
Gln	Gln	Ala	Glu	Leu	Gly	Gln	Arg	Val	Gly	Leu	Phe	Pro	Pro	Pro	Pro
		690				695					700				
Pro	Pro	Pro	Gln	Val	Thr	Ser	Ala	Ile	Ala	Thr	Leu	Gln	Gln	Ala	Ala
705					710					715					720
Ala	Met	Ser	Phe	Cys	Pro	Gln	Val	Ala	Arg	Pro	Leu	Val	Gly	Pro	Leu
				725					730					735	

Ala Leu Gly Ser Pro Arg Leu Val Arg Arg Pro Pro Gly Pro Ala  
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Pro Ala Ala Ala Ser Pro Gly Pro Pro Pro Pro Ala Ser Pro Pro Gly  
 755 760 765

Ala Pro Ala Ser Pro Arg Ala Pro Arg Thr Ser Pro Tyr Gly Gly Leu  
 770 775 780

Pro Ala Ala Pro Leu Ala Gly Pro Ala Leu Pro Ala Arg Arg Leu Ser  
 785 790 795 800

Arg Ala Ser Arg Pro Leu Ser Ala Ser Gln Pro Ser Leu Pro His Gly  
 805 810 815

Ala Pro Gly Pro Ala Ala Ser Thr Arg Pro Ala Ser Ser Ser Thr Pro  
 820 825 830

Arg Leu Gly Pro Thr Pro Ala Ala Arg Ala Ala Ala Pro Ser Pro Asp  
 835 840 845

Arg Arg Asp Ser Ala Ser Pro Gly Ala Ala Gly Gly Leu Asp Pro Gln  
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Asp Ser Ala Arg Ser Arg Leu Ser Ser Asn Leu  
 865 870 875

<210> 16  
 <211> 749  
 <212> PRT  
 <213> Homo sapiens

<220>  
 <223> human hyperpolarization-activated voltage-gated  
 cation channel 2 (HAC2) missing amino terminus

<400> 16  
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Tyr Ser Asp Phe Arg Phe Tyr Trp Asp Leu Ile Met Leu Ile Met Met  
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Val Gly Asn Leu Val Ile Ile Pro Val Gly Ile Thr Phe Phe Thr Glu  
 35 40 45

Gln Thr Thr Thr Pro Trp Ile Ile Phe Asn Val Ala Ser Asp Thr Val  
 50 55 60

Phe Leu Leu Asp Leu Ile Met Asn Phe Arg Thr Gly Thr Val Asn Glu  
 65 70 75 80

Asp Ser Ser Glu Ile Ile Leu Asp Pro Lys Val Ile Lys Met Asn Tyr  
 85 90 95

Leu Lys Ser Trp Phe Val Val Asp Phe Ile Ser Ser Ile Pro Val Asp  
 100 105 110

Tyr Ile Phe Leu Ile Val Glu Lys Gly Met Asp Ser Glu Val Tyr Lys  
 115 120 125

112240:6363

Thr Ala Arg Ala Leu Arg Ile Val Arg Phe Thr Lys Ile Leu Ser Leu  
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 Leu Arg Leu Leu Arg Leu Ser Arg Leu Ile Arg Tyr Ile His Gln Trp  
 145 150 155 160  
 Glu Glu Ile Phe His Met Thr Tyr Asp Leu Ala Ser Ala Val Val Arg  
 165 170 175  
 Ile Phe Asn Leu Ile Gly Met Met Leu Leu Leu Cys His Trp Asp Phe  
 180 185 190  
 Cys Leu Gln Phe Leu Val Pro Leu Leu Gln Asp Phe Pro Pro Asp Cys  
 195 200 205  
 Trp Val Ser Leu Asn Glu Met Val Asn Asp Ser Trp Gly Lys Gln Tyr  
 210 215 220  
 Ser Tyr Ala Leu Phe Lys Ala Met Ser His Met Leu Cys Ile Gly Tyr  
 225 230 235 240  
 Gly Ala Gln Ala Pro Val Ser Met Ser Asp Leu Trp Ile Thr Met Leu  
 245 250 255  
 Ser Met Ile Val Gly Ala Thr Cys Tyr Ala Met Phe Val Gly His Ala  
 260 265 270  
 Thr Ala Leu Ile Gln Ser Leu Asp Ser Ser Arg Arg Gln Tyr Gln Glu  
 275 280 285  
 Lys Tyr Lys Gln Val Glu Gln Tyr Met Ser Phe His Lys Leu Pro Ala  
 290 295 300  
 Asp Met Arg Gln Lys Ile His Asp Tyr Tyr Glu His Arg Tyr Gln Gly  
 305 310 315 320  
 Lys Ile Phe Asp Glu Glu Asn Ile Leu Asn Glu Leu Asn Asp Pro Leu  
 325 330 335  
 Arg Glu Glu Ile Val Asn Phe Asn Cys Arg Lys Leu Val Ala Thr Met  
 340 345 350  
 Pro Leu Phe Ala Asn Ala Asp Pro Asn Phe Val Thr Ala Met Leu Ser  
 355 360 365  
 Lys Leu Arg Phe Glu Val Phe Gln Pro Gly Asp Tyr Ile Ile Arg Glu  
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 385 390 395 400  
 Val Ile Thr Lys Ser Ser Lys Glu Met Lys Leu Thr Asp Gly Ser Tyr  
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Asn	Glu	Val	Leu	Glu	Glu	Tyr	Pro	Met	Met	Arg	Arg	Ala	Phe	Glu	Thr
450						455						460			
Val	Ala	Ile	Asp	Arg	Leu	Asp	Arg	Ile	Gly	Lys	Lys	Asn	Ser	Ile	Leu
465					470					475					480
Leu	Gln	Lys	Phe	Gln	Lys	Asp	Leu	Asn	Thr	Gly	Val	Phe	Asn	Asn	Gln
				485					490					495	
Glu	Asn	Glu	Ile	Leu	Lys	Gln	Ile	Val	Lys	His	Asp	Arg	Glu	Met	Val
			500					505					510		
Gln	Ala	Ile	Ala	Pro	Ile	Asn	Tyr	Pro	Gln	Met	Thr	Thr	Leu	Asn	Ser
		515					520					525			
Thr	Ser	Ser	Thr	Thr	Thr	Pro	Thr	Ser	Arg	Met	Arg	Thr	Gln	Ser	Pro
	530					535					540				
Pro	Val	Tyr	Thr	Ala	Thr	Ser	Leu	Ser	His	Ser	Asn	Leu	His	Ser	Pro
545					550					555					560
Ser	Pro	Ser	Thr	Gln	Thr	Pro	Gln	Pro	Ser	Ala	Ile	Leu	Ser	Pro	Cys
				565					570					575	
Ser	Tyr	Thr	Thr	Ala	Val	Cys	Ser	Pro	Pro	Val	Gln	Ser	Pro	Leu	Ala
			580					585					590		
Ala	Arg	Thr	Phe	His	Tyr	Ala	Ser	Pro	Thr	Ala	Ser	Gln	Leu	Ser	Leu
		595					600					605			
Met	Gln	Gln	Gln	Pro	Gln	Gln	Gln	Val	Gln	Gln	Ser	Gln	Pro	Pro	Gln
	610					615					620				
Arg	Gln	Pro	Gln	Gln	Pro	Ser	Pro	Gln	Pro	Gln	Thr	Pro	Gly	Ser	Ser
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Pro	His	Glu	Val	Ser	Thr	Leu	Ile	Ser	Arg	Pro	His	Pro	Thr	Val	Gly
		675					680					685			
Glu	Ser	Leu	Ala	Ser	Ile	Pro	Gln	Pro	Val	Thr	Ala	Val	Pro	Gly	Thr
	690					695					700				
Gly	Leu	Gln	Ala	Gly	Gly	Arg	Ser	Thr	Val	Pro	Gln	Arg	Val	Thr	Phe
705					710					715					720
Phe	Arg	Gln	Met	Ser	Ser	Gly	Ala	Ile	Pro	Pro	Asn	Arg	Gly	Val	Leu
				725					730					735	
Pro	Ala	Pro	Leu	Pro	Leu	Ile	Thr	Pro	His	Pro	Lys	Lys			
			740					745							